Citation
harman/kardon

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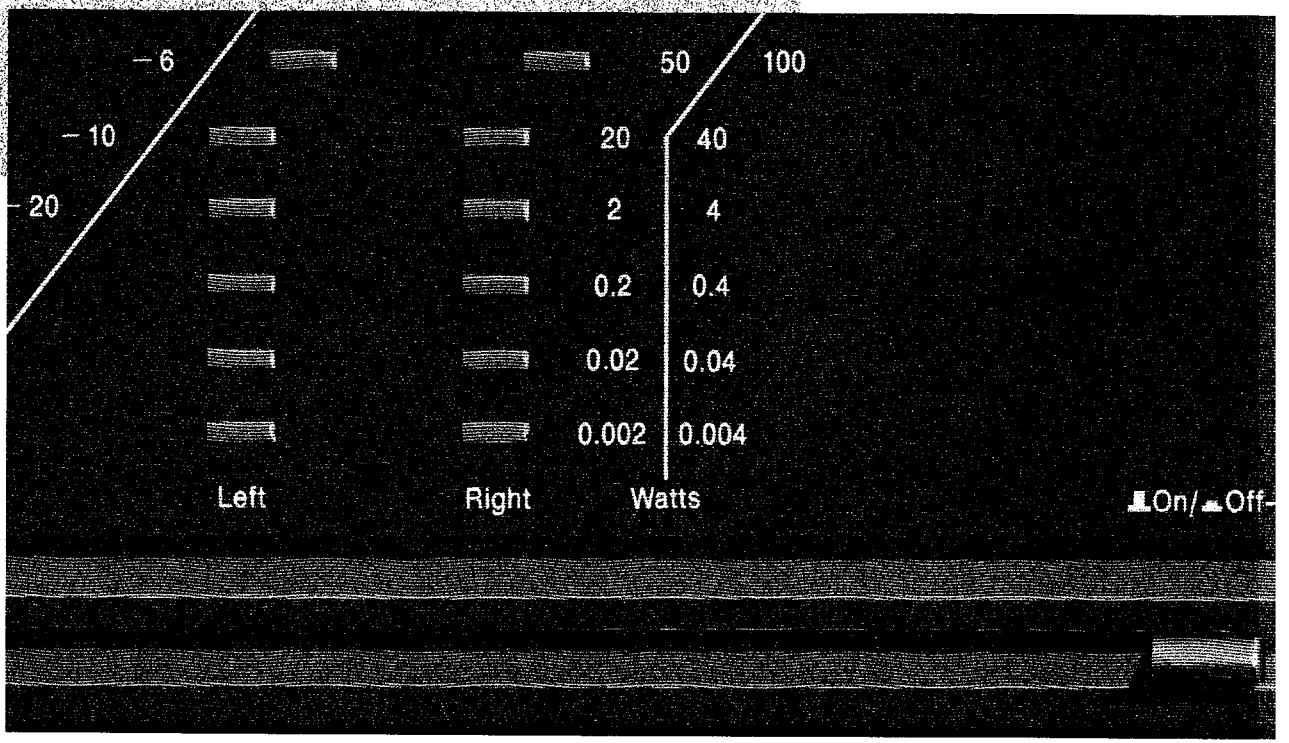
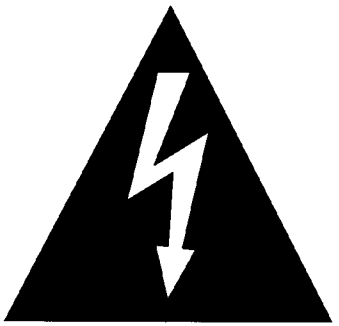


High Voltage/High Current Power Amplifier Instruction Manual

Rear Panel Safety Precautions

CAUTION: TO REDUCE THE RISK OF ELECTRICAL SHOCK, DO NOT REMOVE COVER (OR BACK). NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL.



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure, that may be of sufficient magnitude to constitute a risk of electrical shock to persons.

The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions within the literature accompanying the component.

1. Read instructions—all safety and operation instructions should be read before using the power amplifier.
2. Retain instructions for future reference.
3. Heed warnings—all warnings on the power amplifier and in its operations instructions should be adhered to.
4. Follow all instructions.
5. Water and moisture—do not use the power amplifier around water, for example near a swimming pool, sink or in a wet basement.
6. Ventilation—The power amplifier should be situated so that its location or position does not interfere with its proper ventilation (see detailed instructions farther on).

7. Heat—The power amplifier should be situated away from heat sources such as radiators, fireplaces, stoves, electric popcorn poppers or other appliances that produce heat. Also avoid prolonged contact with direct sunlight and extremely low temperatures.

8. Power sources—The power amplifier should be connected ONLY to a power supply of 120 volts, 60 cycles.

9. Power cord protection—Power supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plugs, convenience receptacles and the point at which the cord exits from the power amplifier. Also never pull or stretch the cord.

10. Cleaning—Do not use volatile solvents such as alcohol, gasoline, benzine etc. to clean the power amplifier cabinet. Use only a clean dry cloth. If you must use a wet cloth, wet only the cloth lightly with water.

11. Object and liquid entry—Care should be taken so that objects (including excessive dust) do not fall into the unit, and that liquids are not spilled into the inside of the power amplifier.

12. Abnormal smells—If an abnormal smell or smoke is detected, immediately turn the amplifier power OFF and pull out the power cord. Contact your dealer or nearest Harman Kardon Service station.

13. Damage requiring service—The power amplifier should be serviced by qualified service personnel when:

A. The power supply cord or the plug have been damaged; or
B. Objects have fallen, or liquid has been spilled into the power amplifier; or
C. The power amplifier has been exposed to rain; or
D. The amplifier does not appear to operate normally in performance (see further information in this manual); or
E. The power amplifier has been dropped or the cabinet damaged.

14. Servicing—The user should not attempt to service the power amplifier beyond those means described in this manual. All other servicing should be referred to qualified service personnel.

15. **IMPORTANT SAFETY PRECAUTION FOR AC PLUG**

CAUTION: TO PREVENT ELECTRIC SHOCK, DO NO USE THE CITATION 22 OR CITATION 24'S POLARIZED PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

BRANCHEMENT DE LA FICHE SECTEUR

ATTENTION: POUR PREVENIR LES CHOCS ELECTRIQUES NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR. UNE PRISE DE COURANT OU UNE AUTRE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS EN LAISSER AUCUNE PARTIE A DECOUVERT.

Introduction

Important Design Features of the Citation 22 and Citation 24 Power Amplifiers.

Thank you for choosing Citation.

Judging from your choice of power amplifiers, you are a discriminating music listener. You now own a superb piece of high fidelity equipment. Used properly, you are about to begin thousands of hours of musical enjoyment.

While you are probably no beginner when it comes to high fidelity components, we nevertheless ask you to read and carefully follow the instructions in this manual, to insure a successful partnership between you and your new Citation Power Amplifier.

Actual hook-up instructions begin on page 7.

High Instantaneous Current Capability

It has long been proven both theoretically and in the real world that loudspeakers regularly draw extremely high currents in reaction to dynamic voltage fluctuations in music. Producing a design with simultaneous high current, high voltage and high- speed performance requires rugged, large-capacity electrical and electronic components. Your Citation Series Power Amplifier uses special industrial-grade, triple-diffusion, bi-polar power and driver transistors which are fully capable of both speed and ruggedness.

Wide Open-Loop Bandwidth with Low Negative Feedback

Many amplifier designs compromise overall sound quality in the quest for lower and lower Total Harmonic Distortion specifications by incorporating excessive negative feedback. We have taken the far more difficult route of designing the Citation 22 and 24 from the very beginning for inherently lower gain, low Total Harmonic Distortion and very wide open-loop bandwidth. Careful use of minimal negative feedback produces still wider bandwidth and even lower THD. Incoming music signals are perfectly correlated to any necessary low level negative feedback, resulting in extremely fast amplifier reaction time.

Symmetrical Circuitry

Instead of settling for less expensive asymmetrical circuitry, (with excessive amounts of feedback correction to avoid even order harmonic distortion), the Citation 22 and 24 employ fully symmetrical circuitry in each individual stage from the input jacks to the speaker terminals. Complex musical waveforms are reproduced flawlessly, and the resulting sound is relaxed and natural.

Symmetrical Layout and Construction

We have treated your Citation amplifier design as two individual mono amplifiers with only a power cord and a chassis in common. Each channel is fully independent from preamplifier input to speaker terminals to minimize crosstalk and differing power demands. Low level preamplifier inputs are mounted as far as is physically possible from the dual power transformers. Since flux generation from their windings is inescapable, we have oriented the input circuitry vertically, in parallel to the flux pattern of the transformers for minimum interaction. The result is almost complete freedom from internal noise interference. In addition, power storage capacitors are placed in the closest possible proximity to power transistors, so energy can be instantaneously transferred to the output devices.

Dual Optimization to Solve the Current/Voltage /Impedance Compromise

An amplifier's power capabilities are in almost direct proportion to the quality (and cost) of the **power supply, power transistors** and **heatsink/chassis** assembly. Since these three component groups dictate the maximum continuous power of an amplifier, they must be designed to handle all possible speaker loads, from 16 ohms all the way down to 4 ohms or below. Because you only own speakers of one impedance rating, in most cases either 8 or 4 ohms, you are forced to pay the penalties of compromise in either reduced capabilities or sound degradation.

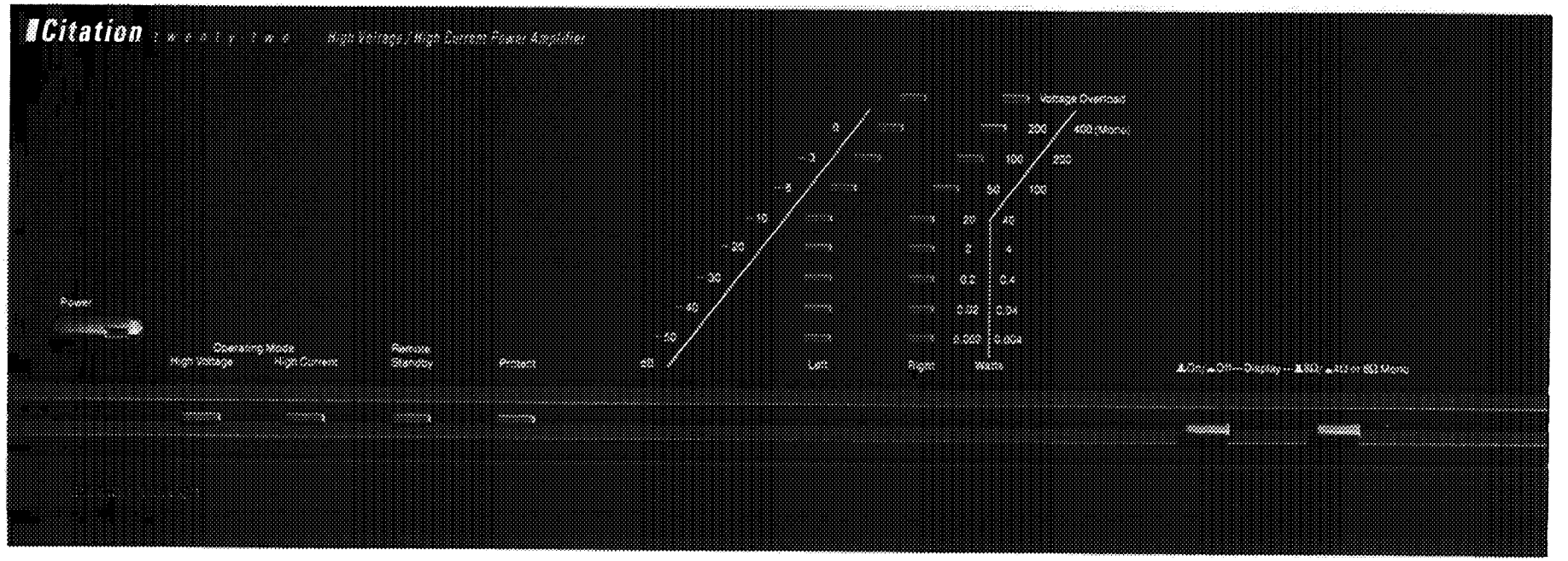
Speakers are not simply resistive loads. Instead they are complex and reactive, drawing disproportionately large "in-rush" currents in reaction to transient voltage signals. Because music is dynamic, with multiple instantaneous peak power demands, the speaker is constantly bombarded with short transient voltage drive signals and constantly drawing short "in-rush" currents. The overall **long term** voltage and power draws are not significantly higher than those of a resistive load. But at any given moment, peak "in-rush" currents must be delivered far in excess of the average demands. If these cannot be supplied by an amplifier design, distortion and reduced dynamic range result. Either current limiting could be imposed (which degrades sound quality when current demands trigger the limiting circuit) or, to avoid current limiting, the design had to be made to withstand the great power draw of 4-ohm loads. Unfortunately designs which could deliver continuous music amplification into 4-ohm speakers ended up penalizing 8-ohm speaker owners by delivering 33% to 50% LESS POWER!

The Citation 22 and Citation 24 provide an elegant, **affordable** solution which optimizes their current and voltage for both 4 and 8-ohm speaker loads while actually improving sonic performance and yet does not overload the average music lover's budget.

The solution is individual optimization for 4 and 8-ohm loads in your Citation Power Amplifier. For 8-ohm speakers, this means the amplifier can deliver an output voltage high enough so that the speaker can draw the current necessary for the amplifier's rated power output. Current needn't be limited since the 8-ohm impedance draws a predictably nominal amount. For 4-ohm speakers (which tend to draw more current), maximum voltage is reduced, causing the load to draw the correct amount of current for your amplifier's rated output.

By designing so that optimum 8-ohm and 4-ohm power outputs are the same, Citation engineers have been able to realize very large cost savings, since the amount of heat dissipation in each mode is also the same. Heat sinks, power transistors and chassis can all be chosen based on common operating needs and 4-ohm loads are no longer the "worst case." An added benefit is higher power output for bridged-mono operation into 8-ohm loads, by simply selecting the 4-ohm (lower voltage range) mode, engaging the Bridged-Mono switch, and following the instructions on page 8.

Citation 22 and Citation 24 Features



The following is a short explanation of the operating controls and features on the front and back of your Citation Series Power Amplifier.

Front Features

Beginning on the far left hand side is the **Power Switch**. Always turn on the rest of your system FIRST, since other components in the signal chain often produce turn-on transients, loud THUMP's which can cause potential damage to your speakers (and ears). Conversely, when turning off the system, shut down your Citation Power Amplifier first.

Next are two **Operating Mode** lights. The **High Current** light will remain on at all times during operation of the amplifier in either 8-ohm or 4-ohm modes and also serves the purpose of a "power on" indicator light. The **High Voltage** indicator will light if you have switched your amplifier to the 8- ohm mode. (More on this subject farther on in this manual).

The **Remote Standby** light is for use with future remote controlled Citation preamplifiers. This feature is not found on Citation 24 Power Amplifiers sold in North America.

The next indicator is extremely important. Should your Citation Power Amplifier experience thermal overload, or if a short circuit develops in your speakers or their cables, the Citation 22/24 will mute sound output while activating internal protection circuits. At this time the **Protect** indicator will light. If the amplifier has overheated, the Protect light will remain on until the unit cools down. This usually takes several minutes, depending on the amount of ventilation and environmental temperature. If the Protect light turns on while the amplifier is cooling down, check for a short circuit, beginning at the speaker terminals on the back of the amplifier, and proceeding through the speaker cables and finally the speakers themselves. In the rare event the Protect indicator stays on even when the amplifier is cool and your speaker cables have completely been removed, there is an internal problem within the power amplifier and you should consult your Harman Kardon dealer.

The Citation 22 employs a double display of 9 LED's to indicate **Power Output**. These consist of 8 lights calibrated linearly in dB from -50 to 0dB, and logarithmically for output wattage. There are two such scales printed on the face of the power amplifier, one each for stereo and bridged-mono output.

Each channel also has a ninth LED marked **Voltage Overload**. A sort of "red line" indicator, these react when the amplifier is entering a clipping condition where it cannot complete the musical waveform demanded of it. From a purely sonic standpoint, you should avoid driving the amplifier so hard that this occurs. Realistically, you may allow the indicators to occasionally light on momentary peak passages without consequences. However, if the Voltage Overload LED's are lighting constantly, you are courting thermal overload and the Citation Power Amplifier's protection circuits will activate at some point.

The entire 9-LED power output display is controlled by the **On/Off** button. Whether or not you choose to use the Citation's display depends largely on your own taste and how hard you drive the amplifier. If you play your music loud and/or have relatively inefficient speakers which demand large amounts of power, you should leave the display on to monitor potential clipping. If you operate the Citation 22 at lower levels, and feel that the "dancing" lights are a distraction, you may leave the display off.

The final button is used in conjunction with the 4-ohm/8-ohm switch on the back of the amplifier to match the display to the impedance of the speakers used. It remains "out" if you are using 8-ohm speakers, or is pushed "in" for 4-ohm speakers or 8-ohm mono operation.

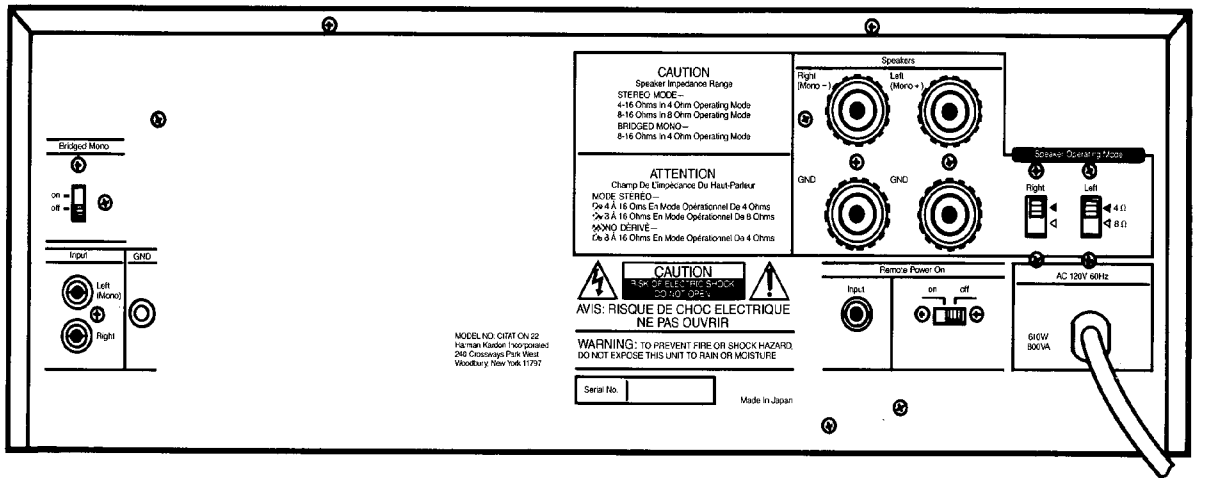
Rear Features

At the far left of the Citation 22 and Citation 24's rear panel are the **input jacks, Bridged-Mono switch** and **ground** terminal.

For normal stereo operation, both left and right jacks are used for the line level signal from your preamplifier, and the Bridged-Mono switch is left OFF.

At the right of the back panel are the **Speaker Terminals** and two switches marked **Speaker Operating Mode. Both switches must be set based on the impedance of your loudspeakers.** This will be covered in the next section of this manual.

You will also notice a small input socket and switch marked **Remote Power On.** (Except Citation 24's sold in North America) This section is for use in conjunction with future remote control Citation components and will not be used at this time. Make sure that the Remote Power On switch is set to the OFF position.



Citation 22 and Citation 24 Set-up

Packing and Paperwork

Save all packing material from your Citation Power Amplifier. While the box is quite large and may be a nuisance to store, it is essential for shipping if you move or should the unit ever need repair.

Also be sure to fill out the warranty card and save your sales receipt in a safe place. It is necessary to establish the date on which your warranty begins, and as proof of ownership in the event of something drastic such as fire or theft.

Placement

Along with proximity to your other stereo components, the major consideration should be in placement of your Citation 22 or Citation 24 Power Amplifier is ventilation. Since the amplifier uses bottom-to-top chimney convection cooling, care should be taken not to block the natural flow of air below and above the unit. If you stack another component, such as a preamplifier, on top of your Citation Power Amplifier, make sure that its own "feet" provide at least 3/8″ clearance between the unit's bottom panel and the top panel of your Citation power amp. Naturally you should also avoid blocking the power amplifier's own bottom clearance by avoiding the urge to use this niche for storing magazines, owner's manuals, CD's etc.

Speaker Connection

Cabling. For optimal sonic performance, you should use the highest quality speaker cables you can afford. However, common "zip cord" from a hardware store can be employed if care is taken to use the proper gauge. This will depend on the distance from the Citation Power Amplifier to your speakers. Use the following chart as a guide:

WIRE LENGTH	GAUGE OF COPPER WIRE
Up to 8 ft	18 gauge
Up to 12 ft	16 gauge
Up to 20 ft	14 gauge
Up to 30 ft	12 gauge
Up to 50 ft	10 gauge

Make sure that both right and left speaker wires are about the same length, even if the distance from amp to each speaker is different. Also, avoid coiling any excess wire near or with audio cables, especially the sensitive cable from your turntable to the preamplifier.

Connection. First, determine the polarity of your speaker wires. If you are using zip cord, they may 1) be different colors, such as silver and copper- colored, 2) have a series of ridges on one conductor, or 3) include a strand of yarn with one conductor.

Note that the speaker terminals on your Citation Power Amplifier are marked Left and Right, with a corresponding Ground terminal for the negative speaker conductor below. A good practice is to use the red/copper/ridged/ yarn conductor for the positive conductor on both amplifier and speaker terminal, and the black/silver/non-ridged/no-yarn conductor for the negative (ground) connection.

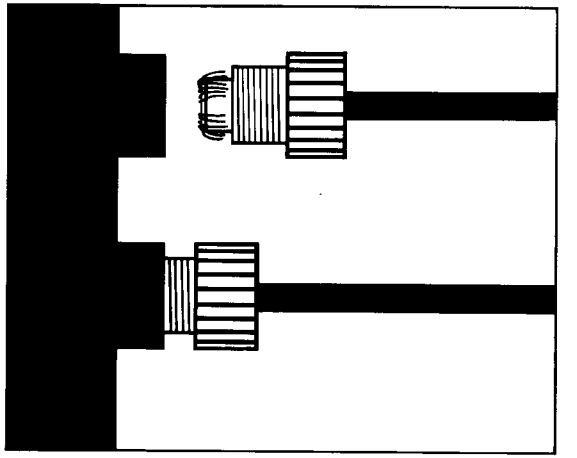


Figure 1: Note bare wire strands spread around back of end post.

1. Strip 1/2 inch of insulation off the end of each speaker wire.
2. Completely unscrew and remove the end posts from all four Citation Power Amplifier speaker terminals. Note that each end post is hollow.
3. Taking care to maintain proper polarity (positive to positive/ negative to negative), insert the speaker wire into the center of each end post, so that half the length of the bare wire protrudes at the other end.
4. Now spread the individual wires in each conductor back around the end of the post. (See Figure 1)
5. Finally, screw the end posts firmly back into the terminal posts. Because the post surfaces are gold-plated, exceptionally good electrical contact will be made.

Speaker Operating Mode Switch

Determining the impedance of your speakers. For proper performance, you must set the Speaker Operating Mode switch to correspond with the impedance load of your loudspeakers. There are a number of possibilities here:

1. You may know the impedance of your speakers. If so proceed to the next section.
2. If you don't know, it may be, A) printed on the back of the speaker, B) noted in the speaker's owner's manual, C) available by calling your dealer or the manufacturer.
3. If all these possibilities fail, you may be able to determine it yourself with an ohm meter. The actual impedance will be 20%-30% higher than the reading on the meter. However, this method will not work on transformer- coupled or capacitor-coupled loudspeakers.

Setting the switches. If your speakers are rated at 4 or 6 ohms, set both switches to the top (4-ohm position). If you have 8-ohm speakers, set the switch to the lower (8-ohm position). Should you change speakers, or add extension speakers (which changes the overall impedance) you should reset the Speaker Operating Mode switch at that time.

Preamplifier Connection

Again, we advocate using high quality connecting cables to get the most from your Citation Amplifier's extremely wide frequency bandwidth capabilities. Make sure that left preamplifier output is connected to the left Citation amplifier input, etc.

Operating Tips

Power Connection

We recommend that your Citation 22 or Citation 24 Power Amplifier line cord be plugged directly into a polarized wall socket. If you must use an extension cord or power strip, check that it is terminated in a polarized plug and rated in excess of the power to be drawn as printed on the back panel of your Citation Power Amplifier.

Final Phasing Test

After checking your connections one final time, it's now time to turn on your Citation Power Amplifier and begin enjoying its great sonic performance.

We suggest you use your first listening experience to double-check your amplifier-to-speaker connections for proper phasing.

Choose a musical source with a single instrumental or vocal, which will be centered in the sound field.

While sitting in a normal listening position in front of and between the speakers, have someone switch the Stereo/Mono button on your preamplifier back and forth. There should be no change in the intensity or imaging of the vocal or instrumental. If there IS a change, one of the speakers has been connected out of phase. This will result in poor stereo imaging and a diminution of bass. Re-check the polarity of your speaker-to-amplifier connections.

No further adjustments are necessary unless you change to speakers of a different impedance.

A Note on Grounding

The vast majority of system hook-ups do not require special grounding between the amplifier and preamplifier. However, in the rare event that the addition of the Citation 22 or Citation 24 has created a 50/60-cycle hum problem, you may take advantage of the ground terminal provided on the power amplifier.

First check that all line cords and speaker cables are well away from sensitive line level hook-up cords, especially the one running from your turntable to the preamplifier.

Upon hooking up your Citation Power Amplifier, you will immediately notice an improvement in the sound of your system from now on. Bass will be tighter and more controlled. Midrange will be sweet and sonorous. And high end will be smooth and extended. The imaged sound field should be wider, deeper and more detailed.

By way of review, remember the following tips which will help you get the most from your Citation Power Amplifier.

1. Turn on the Citation 22/24 LAST when you begin a listening session, and FIRST when you finish, to avoid possible switching transients caused by other components.
2. Do not operate the amplifier at levels which will cause the Voltage Overload indicators to light regularly for long intervals or stay on.
3. Make sure that the Speaker Operating Mode switch setting corresponds to the impedance of your loudspeakers.
4. When cleaning your Citation Power Amplifier, avoid the direct use of dusting sprays, abrasive cleaners or caustics (such as dilute ammonia window cleaning solutions). Use only a mild soap and water solution, applied by a soft cloth, rather than sprayed directly onto the amplifier.

Eight-Ohm Mono Operation

The Citation 22 and Citation 24 have exceptional capabilities as mono amplifiers, either in pairs (dual mono) or for use with a single 8-ohm subwoofer.

Operation in this mode differs from stereo in four important ways.

1. The **Bridged-Mono** switch is set to the ON position.
2. The **Speaker Operating Mode** switch is set to the **4-ohm** setting (even though mono operation should only be with 8-16-ohm loads).
3. Input signal is received only through the LEFT input socket.
4. The single set of speaker conductors are connected to the LEFT and RIGHT (positive/red) output terminals. In this special case, the LEFT terminal acts as positive and the RIGHT terminal acts as ground.

Make sure that the Indicator button on the far right amplifier front panel is set to the "4-ohm or 8-ohm mono" setting.

Multiple Speakers in Parallel

It is possible to add extension speakers, for use in another part of your home, or for matrix surround sound—**if the total impedance of both speaker pairs is no less than 4 ohms.**

Total impedance (Z) of such as system is calculated with the following formula:

$$Z = \frac{R1 \times R2}{R1 + R2}$$

Where R1 and R2 are the individual impedances of the two speaker systems.

Therefore, two sets of 8-ohm speakers in parallel represents a 4-ohm total load, well within the operating parameters of your Citation Amplifier, providing you adjust the Speaker Operating Mode switch to the 4-ohm setting.

However, two sets of 4-ohm speakers is a 2-ohm load and is not recommended. If you have any questions, consult your Harman Kardon Dealer before adding a second set of speakers.

Warranty and Service

If you have followed the suggestions in this manual and are reasonably sure that your power amplifier requires service, call the Harman Kardon dealer from which you purchased your Citation 22 or Citation 24. It is important that service be carried out only by a designated Harman Kardon Service agent to insure both proper service and to comply with the terms of the Citation 22 and Citation 24 Limited Warranty.

Remember to keep your sales slip or receipt in a safe place since you will be required to show it for service during the duration of the Limited Warranty.

harman/kardon
A Harman International Company
240 Crossways Park West
Woodbury, NY 11797

Citation 22 Specifications

Continuous Average Power (FTC)	
8 Ohms:	200 Watts per channel, both channels driven from 20 Hz–20 kHz, < 0.08% THD
4 Ohms:	200 Watts per channel, both channels driven from 20 Hz–20 kHz, < 0.08% THD
8 Ohms:	400 Watts bridged-mono from 20 Hz–20 kHz, < 0.12% THD
Dynamic Power (IHF 1 kHz toneburst, one channel driven)	
High Voltage/High Current mode	
8 Ohms:	300 Watts
4 Ohms:	500 Watts
2 Ohms:	800 Watts
High Current Mode	
4 Ohms:	300 Watts
2 Ohms:	500 Watts
Bridged-mono mode	
8 Ohms:	600 Watts
4 Ohms:	1000 Watts
Negative Feedback (overall):	12 dB
HCC (High instantaneous Current Capability):	± 120 Amps
Power Bandwidth, at half-rated output, 8 Ohms:	< 10 Hz–100 kHz
Frequency Response, at 1 Watt output, +0/−3 dB:	0.1 Hz–250 kHz
TIM	Immeasurable
Slew Rate*:	160 Volts/μ sec
Square Wave Rise Time:	1.4μ sec
Signal-to-Noise ratio (ref 1 Watt/rated power output, A-Wtd):	100 dB/123 dB
Input Sensitivity/Impedance:	1.0V/22K Ohms
Damping Factor (8 Ohms):	120
Dimensions	
Width x Height x Depth:	17⅜" x 6⅛" x 15-11/16" 443 x 155 x 398 mm
Weight	45 lbs./20.5 kg

*Measured without input anti-slewing and output isolation networks.

Printed in Japan
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Citation 24 Specifications

Continuous Average Power (FTC)	
8 Ohms:	100 Watts per channel, both channels driven from 20 Hz–20 kHz, < 0.08% THD
4 Ohms:	100 Watts per channel, both channels driven from 20 Hz–20 kHz, < 0.08% THD
8 Ohms:	200 Watts bridged-mono from 20 Hz–20 kHz, < 0.12% THD
Dynamic Power (IHF 1 kHz toneburst, one channel driven)	
High Voltage/High Current mode	
8 Ohms:	140 Watts
4 Ohms:	210 Watts
2 Ohms:	325 Watts
High Current Mode	
4 Ohms:	140 Watts
2 Ohms:	210 Watts
Bridged-mono mode	
8 Ohms:	280 Watts
4 Ohms:	420 Watts
Negative Feedback (overall):	12 dB
HCC (High instantaneous Current Capability):	± 60 Amps
Power Bandwidth, at half-rated output, 8 Ohms:	< 10 Hz–100 kHz
Frequency Response, at 1 Watt output, +0/−3 dB:	0.1 Hz–250 kHz
TIM	Immeasurable
Slew Rate*:	160 Volts/μ sec
Square Wave Rise Time:	1.4μ sec
Signal-to-Noise ratio (ref 1 Watt/rated power output, A-Wtd):	100 dB/115 dB
Input Sensitivity/Impedance:	1.0V/22K Ohms
Damping Factor (8 Ohms):	75
Dimensions	
Width x Height x Depth:	17⅜" x 6⅛" x 15-11/16" 443 x 155 x 398 mm
Weight	33 lbs./15 kg

Feature and specification subject to change without notice.